## **CLAIMS**

- 1. A blue phase liquid crystalline material comprising a mixture comprising at least one bimesogenic compound and at least one chiral compound, wherein the material is capable of stable existence in the blue phase over a temperature range of at least 5°C.
- 2. The blue phase liquid crystalline material according to claim 1, wherein the mixture comprises at least two bimesogenic nematic compounds and at least one chiral compound.
- 3. The blue phase liquid crystalline material according to claims 1 or 2, wherein each bimesogenic nematic compound has the formula M-A-M', wherein A is a flexible chemical linkage and each of M and M'is a mesogen comprising at least 2 aromatic, heterocyclic or cycloaliphatic nuclei joined by a linkage which is more rigid than the flexible chemical linkage A.
- 4. The blue phase liquid crystalline material according to any of claims 1 to 3, wherein the bimesogenic compound includes at least one compound containing a chromophore.
- 5. The blue phase liquid crystalline material according to any of claims 1 to 4, wherein the chiral compound is a chiral nematic compound.
- 6. The blue phase liquid crystalline material according to any of claims 1 to 5, wherein the chiral compound has a helical twisting power in the range 20 to  $100 \mu m^{-1}$
- 7. The blue phase liquid crystalline material according to any of claims 1 to 6, wherein the chiral compound forms 1 to 10% by weight of the liquid crystalline material.
- 8. The blue phase liquid crystalline material according to any of claims 1 to 7, wherein the helical twisting power of the chiral compound multiplied by the proportion in which it is present in the mixture is in the range 3 to 5  $\mu$ m<sup>-1</sup>

- 9. The blue phase liquid crystalline material according to any of claims 1 to 8, wherein the material is capable of stable existence in the blue phase over a temperature range of at least 35 °C and which is capable of stable existence in the blue phase at a temperature below 35 °C.
- 10. A process for the preparation of a blue phase liquid crystalline material which is capable of stable existence in the blue phase over a temperature range of at least 5 °C, the process comprising cooling a mixture of at least one bimesogenic compound and at least one chiral compound from the isotropic state.
- 11. A process for the preparation of a blue phase liquid crystalline material which is capable of stable existence in the blue phase over a temperature range of at least 5 °C, the process comprising cooling a bimesogenic chiral compound from the isotropic state.
- 12. A blue phase liquid crystalline material produced by the process according to claims 10 or 11.
- 13. An optical device comprising a layer of blue phase liquid crystalline material according to any of claims 1 to 9 or 12 enclosed between opposed carrier plates, an AC voltage source operationally connected to the carrier plates and a light source positioned to impinge a beam of light onto the layer of blue phase liquid crystalline material in a direction substantially normal to the plates.
- 14. A process of mirrorless lasing comprising subjecting a blue phase liquid crystalline material according to any of claims 1 to 9 or 12 to high energy pulsed radiation at a wavelength in the visible spectrum.
- 15. A slotted monolithic optical waveguide comprising an electro-optically active material positioned in a slot between two portions of the waveguide and electrodes deployed above the slot to adjust the phase of light travelling in the waveguide, wherein the electro-optically active material is a blue phase liquid crystalline according to any of claims 1 to 9 or 12.